Delft University of Technology

Computer Vision
IN4393

Assignment 2: Harris Corner Detector and SIFT Descriptor

March 5th, 2018

In this assignment, you will be implementing the scale invariant Harris Corner Detector. You will use this detector in order to match images with SIFT descriptor.

Harris Corner Detector

In this part, you will be implementing a scale invariant Harris Corner Detector. All needed functions can be found in lecture slides of this week. (As a first step you can start to compute the entries of the structure tensor matrix which you will use to form your "cornerness"(R)).

The corner points are the local maximum of R. Therefore, in your function you should check for every point in R, if it is greater than all its neighbors (in an $(n \times n)$ window centered around this point) and if it is greater than the user-defined threshold, then it is a corner point.

Also, make your detector scale invariant. In order to build a scale invariant detector you need to work with different scales. All you need to do is to compute scale normalized Laplacians with different sigma values and find corresponding corner points in each level. This time you do an additional check also within levels. Instead of checking local maximum only within neighbors in the same image, you need to find the maximum of the same corner points in different levels (you can use 3×3 searching window in order to match corner points). Now, the points which returned as local maximum are scale invariant. Your function should return the rows of the detected corner points r, and columns of those points c (the first corner is given by *(r(1),c(1))*. Your function should also plot the original image with the corner points plotted on it.

Image Matching with SIFT

In this part, you will be using your corner points detected in the previous section. You will need to build a descriptor for each of these corner points in the given image-a. And try to find closest descriptor in the other given image-b (Euclidean distance). You can define your own threshold for matches to be accepted as correct based on the effect of the ratio-of-the-second-best-match, as mentioned in the lecture (try different possibilities and describe).

You can find an implementation of SIFT at http://www.vlfeat.org/overview/sift.html

Additional point for this assignment can be gained checking the image matching results with corner points returned by Harris Corner Detector and Difference of Gaussian (DoG) [1].

[1]David G. Lowe, Distinctive Image Features from Scale-Invariant Key points, IJCV 2004.